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Published in:
Abstract proceedings 7th Annual Meeting Danish Water Research and Innovation Platform (DWRIP) – Forsknings- og Innovationsplatformen Vand

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

Abstract proceedings

7th Annual Meeting
Danish Water Research and Innovation Platform (DWRIP) – Forsknings- og Innovationsplatformen Vand

Technical University of Denmark
Building 308
DK-2800 Lyngby

31 January 2013

Edited by B.K. Jensen and N. Levysohn

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Abstract
Climate models are the primary source of information in climate change impact studies but they are inherently uncertain. In recent years, probabilistic procedures based on multi-model ensembles have been suggested in order to estimate this uncertainty. However, there are still several challenges in the interpretation of multi-model ensembles, e.g. limited number of data, lack of agreement on what is a good model, biases in climate models, and interdependency of climate projections.

This study investigates the effects of interdependency and common biases in an ensemble of regional climate models (RCMs) on the uncertainty quantification of extreme rainfall projections in Denmark. A Bayesian approach has been developed using the procedure suggested by Tebaldi et al. (2005) in order to quantify the uncertainty. This approach takes into account both the correlation between the climate models and the common biases. The correlation matrix is estimated using the approach suggested by Pennel and Reichler (2011) to estimate the effective number of models in an ensemble. The common bias is included as a parameter in the Bayesian inference.

The results show that the climate model projections cannot be considered independent. If the models are assumed independent, the results will be overconfident. The effect of accounting for the common biases is smaller than accounting for the interdependency of the RCMs. This is possibly due to the bias being assumed constant from present to the future. Further work will investigate the assumption of constant bias. This study highlights the importance of investigating the assumptions underlying multi-model ensembles. These may have serious consequences in the design of climate change adaptation strategies.

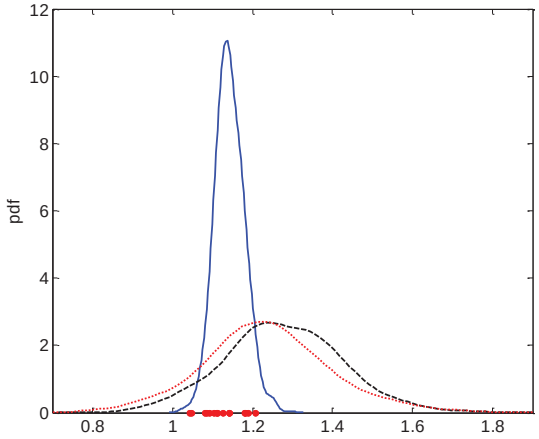

Figure 3- Probability density functions of the relative change of the 95% quantile of wet day rainfall amounts. The results from three different tests are shown: (i) the models are assumed independent and the bias is neglected (blue line), (ii) the interdependency is included in the analysis but the bias is neglected (black dashed line), (iii) both the interdependency and the bias are included in the analysis (red dotted line). The red dots are the outputs from each of the RCMs.

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